

Claims

We claim:

1. A method for synchronizing a CDMA communications signal including the following steps:

transmitting a sequence of forward link CDMA signals from a gateway to an intended subscriber via multiple transponder platforms wherein the forward link CDMA signals comprise ranging calibration data representative of the time each forward link CDMA signal was transmitted from the gateway to each transponder platform;

receiving a sequence of return link CDMA signals from the intended subscriber wherein the return link CDMA signals comprise ranging calibration data representative of the time each forward link CDMA signal was received by the intended subscriber from each transponder platform;

and finding a corresponding time for transmitting subsequent CDMA signals from the gateway to each transponder platform so that subsequent CDMA signals from the multiple transponder platforms arrive at the intended subscriber in substantially the same phase.

2. The method of claim 1 wherein the step of finding a corresponding time for transmitting subsequent CDMA signals includes the step of calculating a time shift of the return link CDMA signal relative to the forward link CDMA signal.

3. The method of claim 1 wherein the step of finding a corresponding time for transmitting subsequent CDMA signals includes the step of calculating a frequency shift of the return link CDMA signal relative to the forward link CDMA signal.

4. The method of claim 1 wherein the step of finding a corresponding time for transmitting subsequent CDMA signals includes the step of calculating a phase shift of the of the return link CDMA signal relative to the forward link CDMA signal.

5. The method of claim 1 wherein CDMA signals arrive at an unintended subscriber from each transponder platform at a substantially different time, frequency, or phase.

6. A method for synchronizing a CDMA communications signal including the following steps:

- transmitting a ranging signal from a gateway to a subscriber via multiple transponder platforms;
- computing a signal propagation time relative to a subscriber local reference clock;
- transmitting signal timing and phase offset information from the subscriber to the gateway via each transponder platform;
- computing relative signal timing and phase data from the signal timing and phase offset information for the subscriber and each transponder platform;
- computing relative motion statistics of each transponder platform relative to the subscriber from the signal timing and phase data;
- averaging the signal timing and phase data for the subscriber and each transponder platform to calculate a subscriber reference clock correction;
- and transmitting the subscriber reference clock correction from the gateway to the subscriber to synchronize the subscriber reference clock so that the subscriber receives subsequent CDMA signals transmitted concurrently from the gateway to the subscriber via each transponder platform in substantially the same phase.

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7. The method of claim 6 wherein CDMA signals arrive at an unintended subscriber from each transponder platform at a substantially different time, frequency, or phase.

8. An apparatus for synchronizing a CDMA communications signal comprising:

a transmitter for transmitting a sequence of forward link CDMA signals from a gateway to an intended subscriber via multiple transponder platforms wherein the forward link CDMA signals comprise ranging calibration data representative of the time each forward link CDMA signal was transmitted by the gateway to each transponder platform;

a receiver for receiving a sequence of return link CDMA signals from the intended subscriber to the gateway via the multiple transponder platforms wherein the return link CDMA signals comprise ranging calibration data representative of the time each forward link CDMA signal was received by the intended subscriber from each transponder platform;

and a CDMA signal sequencer for delaying the transmission of each subsequent CDMA signal to the intended subscriber so that each subsequent CDMA signal

arrives at the intended subscriber from each transponder platform in substantially the same phase.

9. The apparatus of claim 8 further comprising a time shift calculator coupled to the CDMA signal sequencer for calculating a time shift of the return link CDMA signal relative to the forward link CDMA signal.

10. The apparatus of claim 8 further comprising a frequency shift calculator coupled to the CDMA signal sequencer for calculating a frequency shift of the return link CDMA signal relative to the forward link CDMA signal.

11. The apparatus of claim 8 further comprising a phase shift calculator coupled to the CDMA signal sequencer for calculating a phase shift of the of the return link CDMA signal relative to the forward link CDMA signal.

12. The apparatus of claim 8 wherein CDMA signals arrive at an unintended subscriber from each transponder platform at a substantially different time, frequency, or phase.